Gflash Hadronic Lateral Profile Tuning

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Jet Energy and Resolution Group Mini-Workshop

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Overview

- This update:
  - Central part
  - Inclusion of new STT data up to 40 GeV/c
  - Consistent analysis cuts
  - More statistics
  - Fit details slightly modified

- How to combine with plug result?
  (simulation group meeting 12/01/05)

- Conclusions

Lateral Profile Tuning Update

- Tune variable: E/p profile using target tower plus the two adjacent towers in η^{rel}, normalized to absolute data response
- Single isolated track data:
  $p \leq 16$GeV/c: gjtc0d
  $p > 16$GeV/c: gjtc0h_stt15
  tower 1-4
- MC: FakeEv, $\pi^{\pm}/K^{\pm}/\bar{p}p$ (6/3/1)

Gflash hadronic lateral profile

$$f(r) = \frac{2 r R_0^2}{(r^2 + R_0^2)^2} \qquad \langle R_0(E, x) \rangle = R_1 + Q\, x \qquad Q = R_2 - R_3 \log(p/\mathrm{GeV})$$

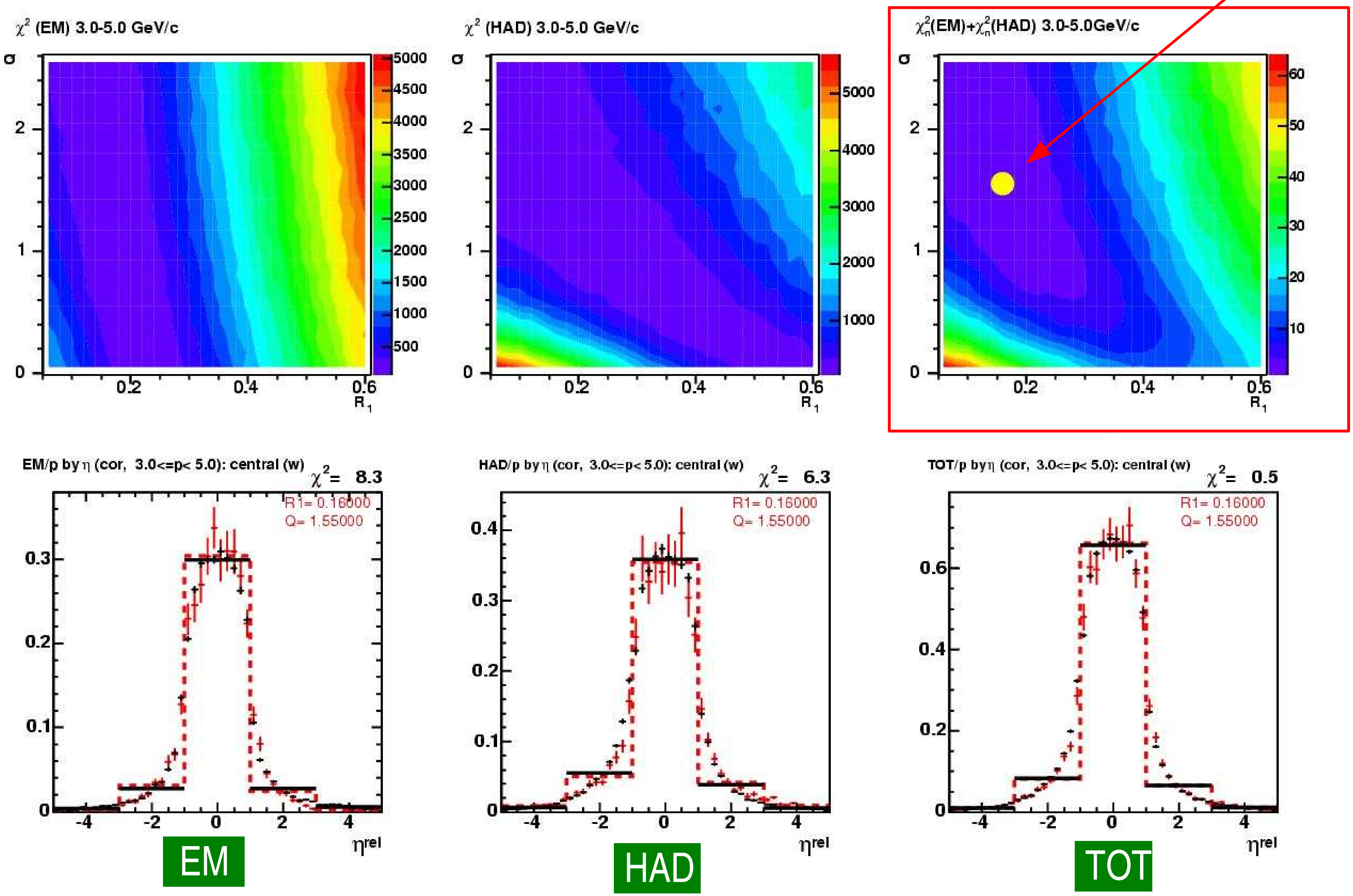
- Extract R1 and Q individually in 9 momentum bins:
  - HAD and EM compartment probe different x ranges and thus provide complementary information about shower development
  - scan (R_1, Q) plane and compare with reference data to calculate χ^2
  - combine information using "normalized" χ^2

$$\{ \chi^2(EM)/N_1 + \chi^2(HAD)/N_2 \} / \mathrm{Min}\{ \chi^2(EM)/N_1 + \chi^2(HAD)/N_2 \}$$

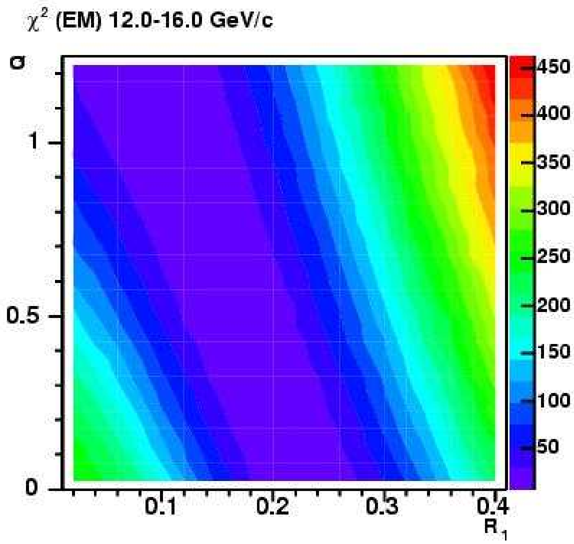
  in order to constrain the parameters and to estimate sensitivity
- R_2 and R_3 determined from momentum dependence of Q using R_1 constraint

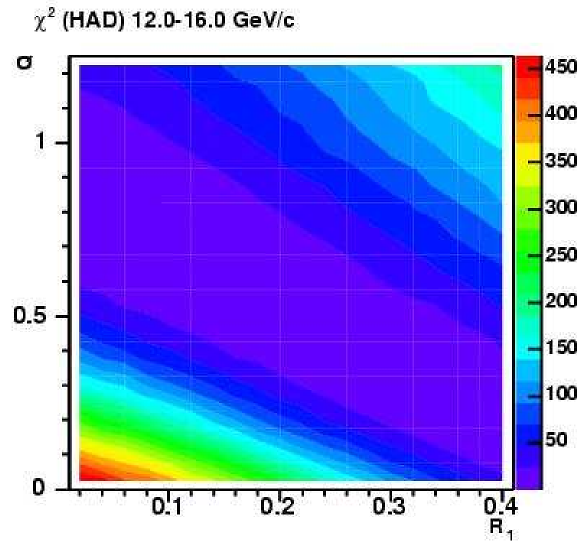
Central, 3-5 GeV/c

using constraint R_1=0.17±0.02

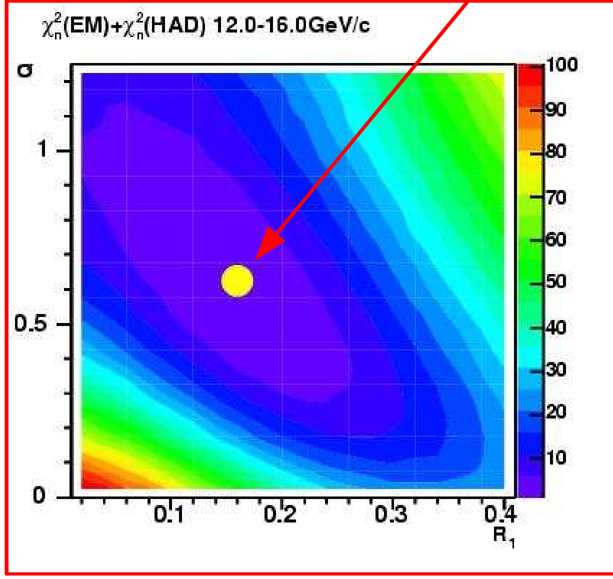


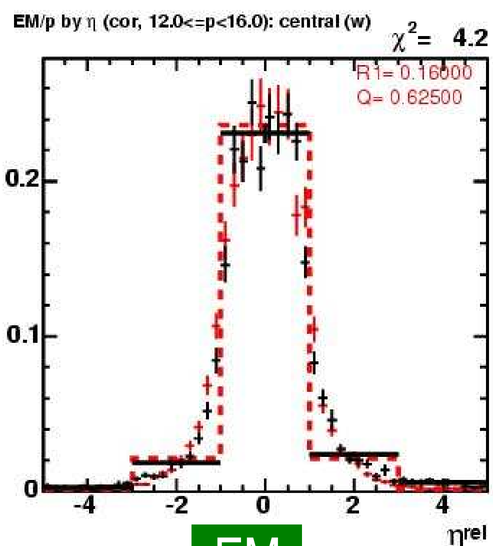
Central, 12-16 GeV/c



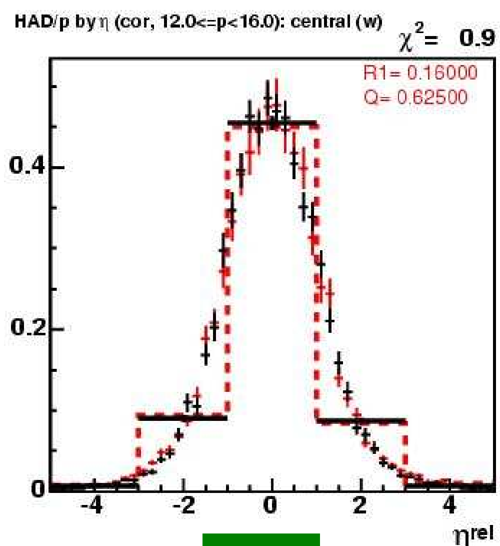


using constraint R_1=0.17±0.02

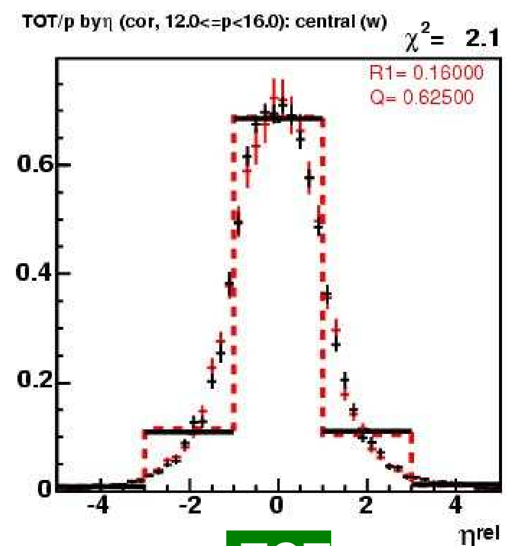




EM



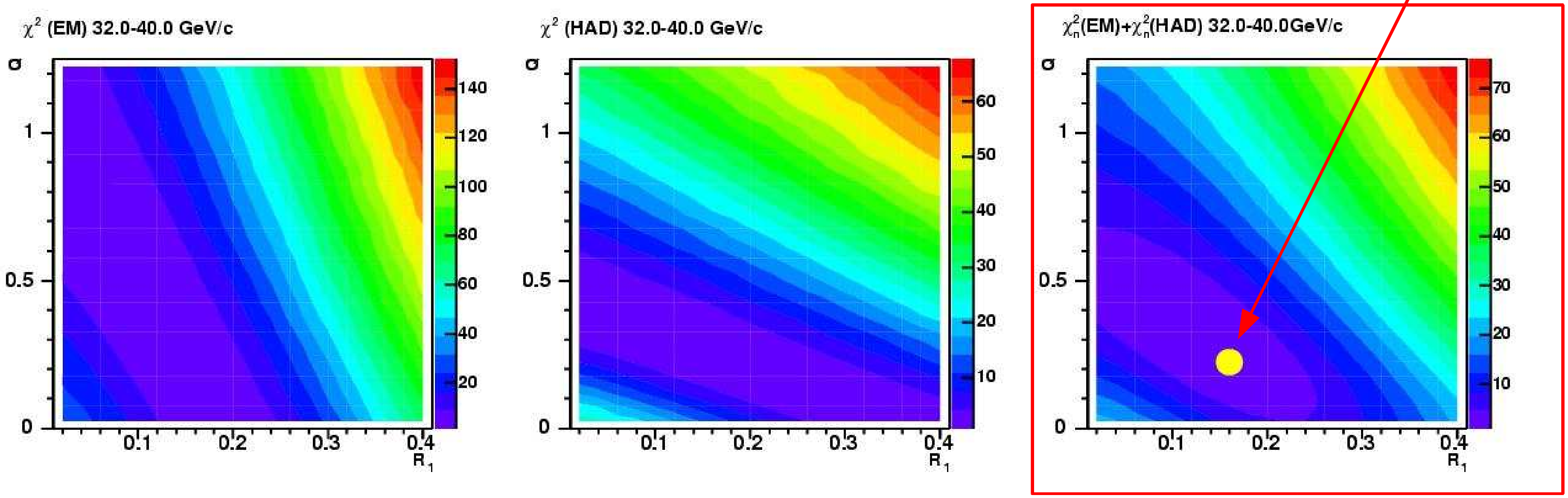
HAD

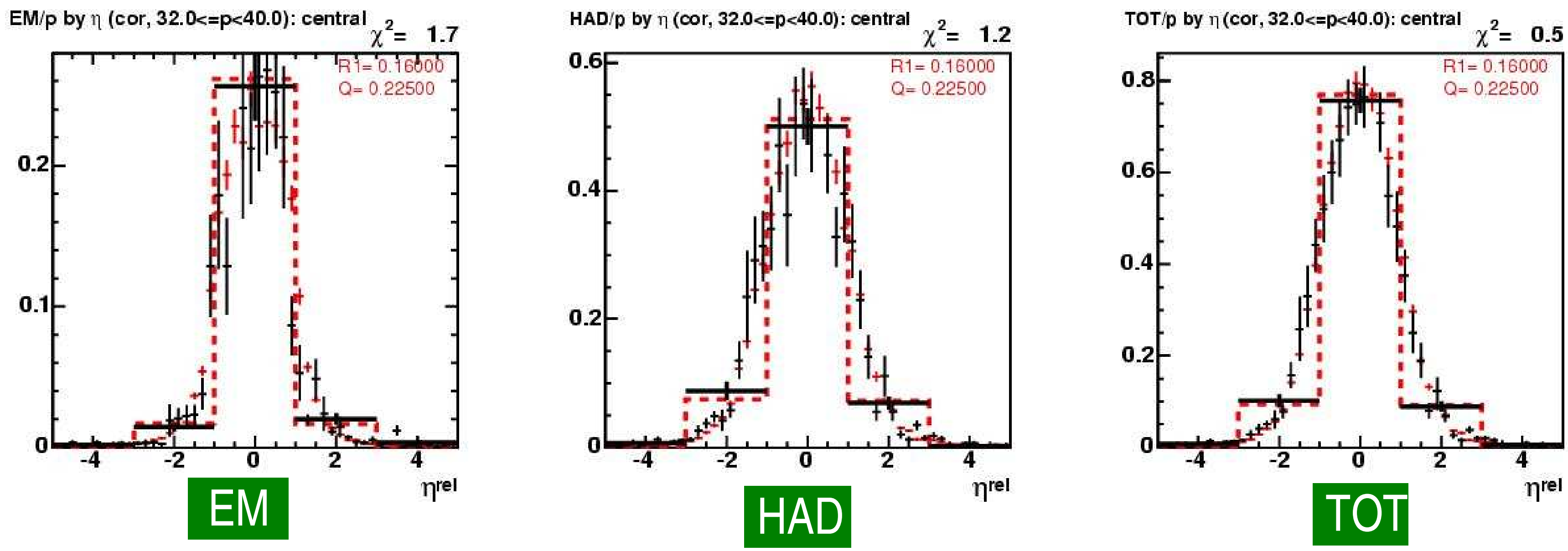


TOT

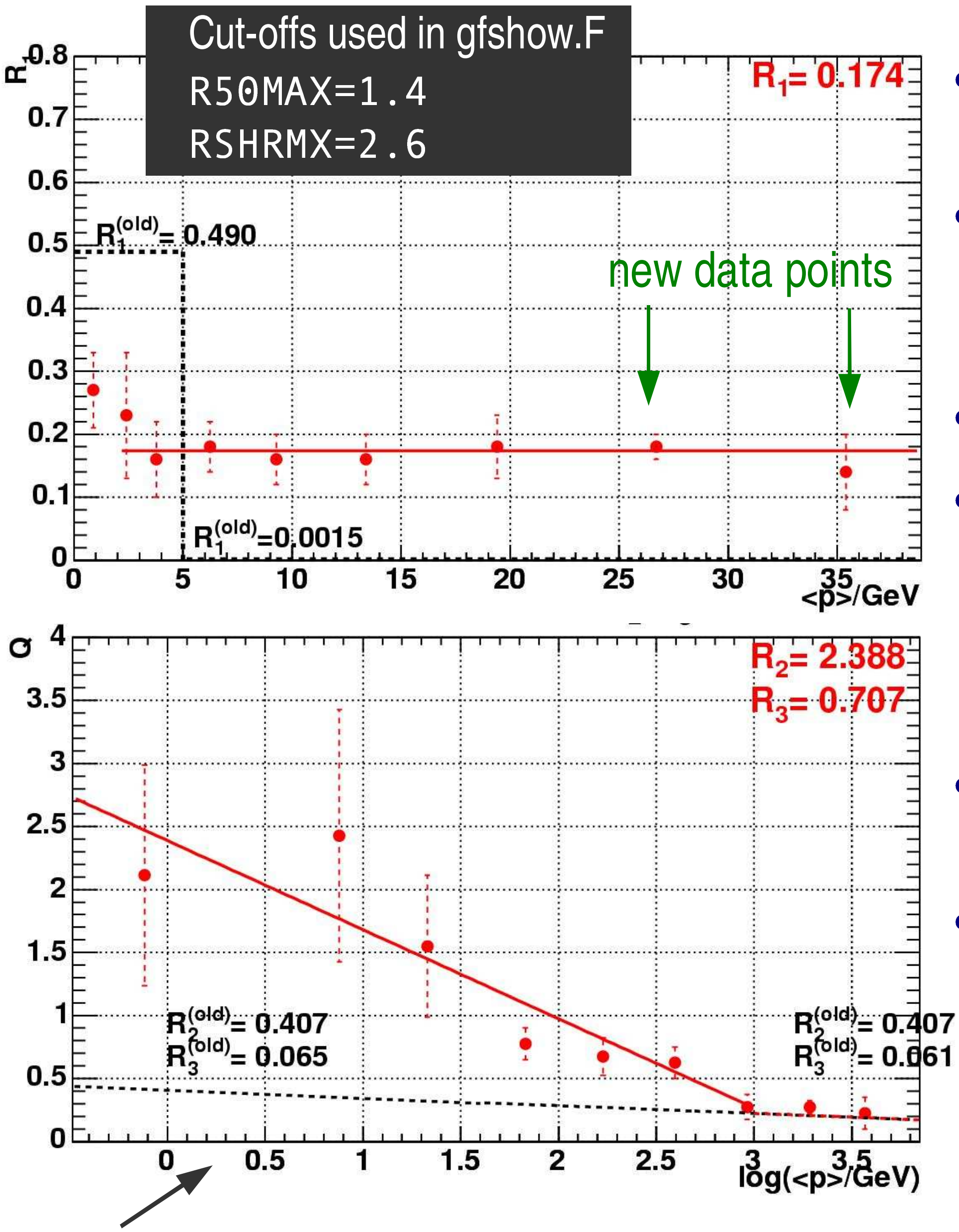
Central, 32-40 GeV/c

using constraint R_1=0.17±0.02





Tune Results (Central)

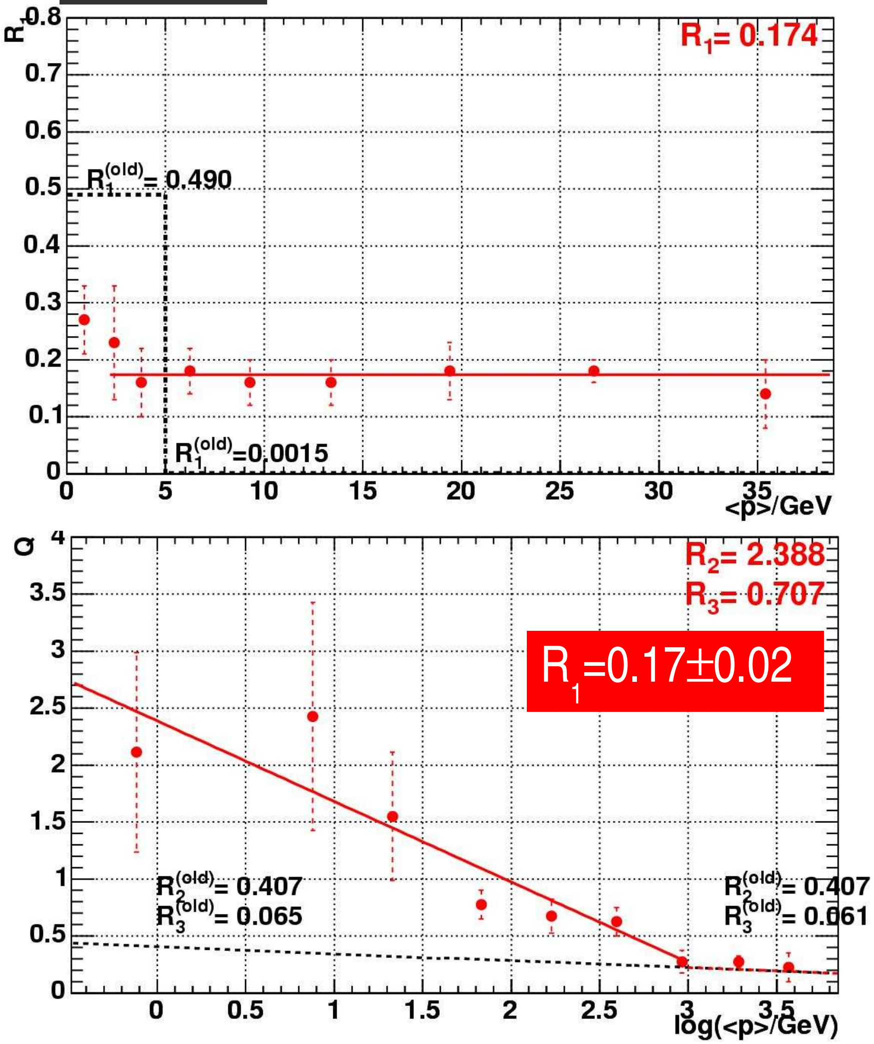


Using R_1 value within a window given by the above fit

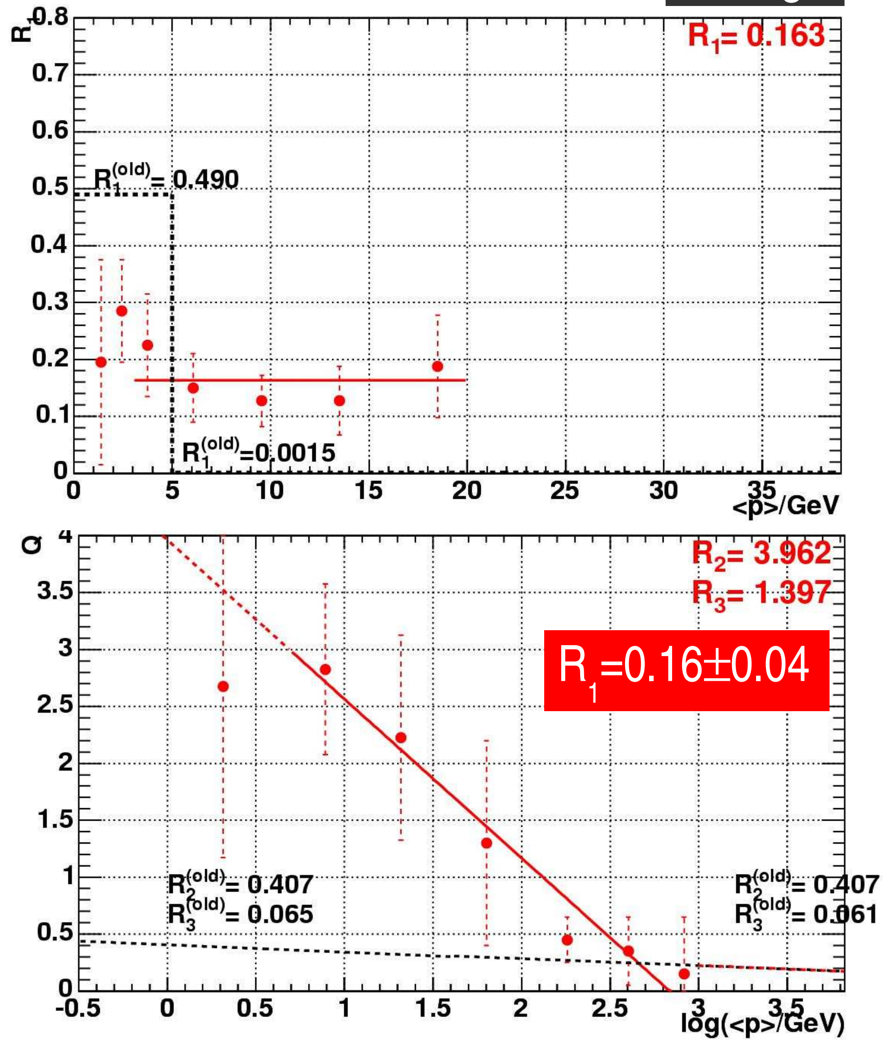
- Core term very stable, spread term difficult to constrain.
- "Error" bars shown indicate variation of a given parameter necessary to increase the normalized χ^2 by one unit (not a real error)
- Fits do not use "error" bars.
- At p<3 GeV/c, Q and R_1 can be traded against each other in order to achive linearity while keeping quality of data description reasonable ($\rightarrow$ R_1 constraint useful)
- Exact value of Q slope or its functional form is not crucial at low p
- Useful parametrization for Gflash:
  p<20GeV/c: result of linear Q-fit
  p>20GeV/c: H1 default (supported by the two new data points)

Central vs. Plug

Central



Plug



- Core term similar, spread term has steeper behaviour in plug region
- Plug needs more MC track statistics for tuning (still on the way)

Conclusions

- New tuned simulated profiles are broader at p>5GeV/c.
- Parametrization Central versus Plug:
  - Use consistent constant R_1 value up to 40 GeV/c (and beyond).
  - For now we are using the parametrization for R_2 and R_3 resulting from Central tuning (more stable). For p>20GeV/c we switch to the H1 default for R_2 and R_3 (supported by in-situ data).
- Updated central results already included in Gen-6 development.
- New tuning does not necessarily contradict past Gen-5 tuning for p<5GeV/c:
  - We reduced lateral core contribution but need to increase spread term
    $\rightarrow$ may leave the profile for a given momentum bin unchanged.
  - Now that we can study the momentum dependence over a larger momentum range we can better disentangle core and spread part.
  - Also certain upper shower cut-offs were relaxed w.r.t. Gen-5
    $\rightarrow$ is expected to reduce R_1
- New lateral profile parameters significantly affect Gen-6 tuning of FEDP (see Shawn's talk)